To users of our inverters : Our inverters are designed to control the speeds of three-phase induction motors for general industry.

⚠ Precautions

* Read the instruction manual before installing or operating the inverter unit and store it in a safe place for reference.
* When using our inverters for equipment such as nuclear power control, aviation and space flight control, traffic, and safety, and there is a risk that any failure or malfunction of the inverter could directly endanger human life or cause injury, please contact our headquarters, branch, or office printed on the front and back covers of this catalogue. Special precautions must be taken and such applications must be studied carefully.
* When using our inverters for critical equipment, even though the inverters are manufactured under strict quality control always fit your equipment with safety devices to prevent serious accident or loss should the inverter fail (such as issuing an inverter failure signal).
* Do not use our inverters for any load other than three-phase induction motors.
* None of Toshiba, its subsidiaries, affiliates or agents, shall be liable for any physical damages, including, without limitation, malfunction, anomaly, breakdown or any other problem that may occur to any apparatus in which the Toshiba inverter is incorporated or to any equipment that is used in combination with the Toshiba inverter. Nor shall Toshiba, its subsidiaries, affiliates or agents be liable for any compensatory damages resulting from such utilization, including compensation for special, indirect, incidental, consequential, punitive or exemplary damages, or for loss of profit, income or data, even if the user has been advised or apprised of the likelihood of the occurrence of such loss or damages.

For further information, please contact your nearest Toshiba Representative or International Operations-Producer Goods.
The information in this brochure is subject to change without notice.

In Touch with Tomorrow

TOSHIBA

TOSHIBA CORPORATION
INDUSTRIAL AND POWER SYSTEMS & SERVICES COMPANY

Overseas Sales & Marketing Department
Electrical Apparatus & Measurement Division
1-1,Shibaura 1-chome, Minato-ku,
Tokyo 105-8001,Japan
Tel.: +81(0)3-3457-4911 Fax.: +81(0)3-5444-9268

04-01 (AB)8692 AB

Printed in Japan

TOSHIBA

Transistor Inverter

Built-in EMI noise filter
Introducing the world's top class compact inverter

1-phase 240V 0.2kW to 2.2kW
3-phase 240V 0.2kW to 15kW
3-phase 500V 0.4kW to 15kW

New Global Standard Inverter **TOSVERT™**

VF-S11

They look the same,
but if you crack the shell you can see the difference.
The VF-S11 is born - the future and potential of inverters.

Complies with major world standards (CE marking, UL, CSA)

ISO 9001:
This inverter series is manufactured at the works, which has received the international quality assurance standard ISO 9001 certification.

The works producing this inverter series is registered as an environment management system factory specified by ISO 14001.

New Global Standard Inverter **TOSVERT™**

VF-S11

Features of the VF-S11 - Highly Functional but Easy-To-Use, Compact and Low-Noise

High Torque

Initial torque surpasses 1Hz-200%* at start up instantly from low speed. Smooth operation in regeneration area as well as motoring area is possible through proprietary power vector control. Moreover, you can make settings in a single step by using the automatic torque boost function with auto tuning accomplished at the same time. Equipped with an energy saving mode, application reach a higher level of efficiency.

* When running a standard Toshiba 4-pole motor. (Depends on the voltage and range.)

Built-in EMI Noise Filter

Environmental consideration is also the very best in its class. Single-phase and 500V devices are equipped with a high-attenuation EMI noise filter greatly reducing the RFI noise limitted by the inverter.

For 1-ph 240V and 3-ph 500V models:
- EN55011 Class A Group 1(Max.5m*) - standard built-in
- EN55011 Class B Group 1(Max.20m*) and Class A Group 1(Max.50m*) - External noise filter option.

For 3-ph 240V models:
- EN55011 Class A Group 1(Max.5m*) and Class B Group 1(Max.1m*) - External noise filter option.

* Length of motor connecting cable.

Compact

Save space with the ultra compact design that has greatly reduced dimensions. Also you can mount multiple units side by side for high-density Intallation. Despite being such a compact model, it has a surprisingly high level of functionality.* Its ease-of-use makes it a top class inverter.

*Refer to the specifications on page 3.

■Side by side installation

Easy maintenance

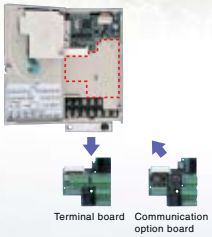
A warning signal is output to the display panel when the electrolytic capacitors on the main circuit, the cooling fan and the control board have been reached the replacement period. A valuable indicator which can be used as a maintenance guideline. The cooling fan can be replaced easily, and the automatic on/off function provides extended product life. On top of that, the main circuit capacitors are designed with a 10year lifetime* making this a long-life inverter. It is designed to be used in ambient temperatures up to 60 ℃ for maximum environmental resistance. (with minimum current de-rating required)

* Ambient temperature: average yearly temperature of 40 ℃.
Output current: Operating 24 hours per day for 365 days at 80% of the current rating.

Removable terminal board

It is the first in its class with removable control terminals giving exceptional ease of maintenance and wiring. The control terminal circuit board can be removed leaving space for an inernally mounted communications option board.

■Removable terminal board



Extended power range

Wide range of powers up to 15kW for this class of inverter.

■Line-up

Input voltage class	Applicable motor (kW)										
	0.2	0.4	0.55*	0.75	1.5	2.2	4.0	5.5	7.5	11	15
1-phase 240V	■	■	■	■	■						
3-phase 240V	■	■	■	■	■	■	■	■	■	■	■
3-phase 500V					■	■	■	■	■	■	■

* 0.55kW is 3-phase 240V class only.

A wealth of functions

Sound basic functions

- With keypad and the frequency setting potentiometer on the front panel, you can start operation easily and immediately.
- Every model has a regenerative braking circuit built-in, so only an optional braking resistor needs to be connected if required.
- All three-phase and single-phase 200V models with a capacity of 0.75kW or less are capable of self-cooling without needing fans.

Completely noise-proof

- An optional EMC plate can also be attached with a built-in noise filter. This facilitates the wiring of shielded cables to ground, and to the machine ground.
- If leakage current is a problem, disconnecting the grounding capacitor can reduce it by simply pulling up a jumper switch (Single-phase 200V and three-phase 400V models).

A wide variety of input terminal functions

- Two analog input terminals can be used as logic input terminals by changing parameter settings.
- If the two analog input terminals are switched over to logic input terminals, up to eight contact input terminals can be used at a same time.
- A function can be selected from among 65 functions and assigned to each individual contact input terminal.
- With a slide switch, you can easily switch between sink logic and source logic configurations.
- Power can be supplied from either the internal power supply (24V) but also an external power supply (optional). In the latter case, power is supplied through the PLC terminals.

A great variety of output terminals

- Three output terminals are provided: a relay contact output terminal (1c), a relay contact terminal (1a) and an open collector output terminal.
- The open collector output terminal (OUT-NO) completely insulated from other terminals, which can also be used as a pulse train output terminal.
- A function can be selected from 58 functions and assigned to each individual output terminal.It is also possible to assign two different functions to a single output terminal, economizing on the use of terminals and cables.
- Analog output terminals can be be set for 0-10V, 0-1mA or 4-20mA.

Easy selection and installation

- All VF-S11 series of inverters can be mounted side-by-side without side clearance allowing for efficient installation in a small cabinet.
- Compact inverters with a wide range of capacities (0.2kW to 15kW) are available.
- Supporting a wide range of supply voltages:
  240V class: 200V to 240V
  500V class: 380V to 500V
  Allowable fluctuations in voltage: +10%, -15%
- Operative in a wide range of ambient temperatures: -10°C to +60°C (When the ambient temperature is 50°C and over, the current needs to be reduced.)
- With an optional DIN rail kit, the inverter can be installed with a single motion.
  Three-phase 240V models: 2.2kW or less
  Single-phase models and 500V models: 1.5kW or less

Dynamic functions

- A dynamic energy saving mode specially designed for fan motors provides substantial energy saving compared to conventional modes.
- The energy saving effect can be checked easily by monitoring integrated input and output kWh, in addition instantaneous power.
- A dynamic quick deceleration control mode was added to conventional deceleration modes achieving faster stopping without using a braking resistor.

A wide choice of monitor menu items

- A list of p to 20 parameters, including load current and torque current, can be monitored during normal operation.
- Even if the inverter is tripped, monitoring of up to parameters can continue until power is turned off.When power is turned off, the last 10 parameters monitored at the occurrence of the last four trips are retained.
- Up to 16 kinds of monitor menu items and up to 4 kinds of outputs for adjustments can be assigned to the analog terminals and the pulse train output terminals. Also, adjustments can be made easily.
- A free-unit scaling function is provided so that various items, such as the rotational speed and the line speed, can also be displayed in addition to the operation frequency. Also, a bias can be specified.

Making complicated settings easily

- With the automatic torque boost function, the motor can be tuned easily for vector control. (The rated current, no-load current and rated rotational speed of the motor need to be set manually.)
- With the automatic acceleration/deceleration function, the time can be set easily.
- With the automatic setting function, can be assigned easily to input terminals on the terminal board.
- With the history function, a parameter that is used repeatedly can be invoked and changed in one operation.
- Every VF-S11 inverter allows you to specify steps in which a value changes each time a button on the operation panel is pressed. For example, if you want to set the freguency by steps of 10 Hz, this feature comes in very handy.

Complete with protective functions

- All possible protective functions are provided to protect the inverter and its peripheral devices.
- More than 30 kinds of information about causes of tripping and more than 20 kinds of alarm information can be displayed.
- Every VF-S11 inverter has the function of protecting from input/output open-phases detecting the breakage of analog signal cables, and protecting from overcurrent, overvoltage and overload.
- User-defined parameter settings can be saved as default settings. After parameters are changed, user default setting can be easily loaded from memory.
- Totally enclosed box type inverters (IP54-compliant and can be brought into IP55-compliance) are also available.

Programmable for a variety of operations

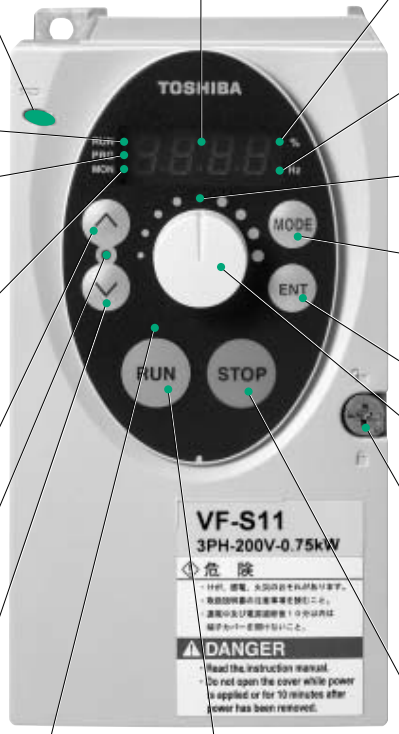
- A PID control function is provided for every VF-S11 series, control devices are not required for PID control. It is also possible to specify a control waiting time and to put out command matching signals.
- Up to three different acceleration/deceleration times can be set, so that the VF-S11 can be put to a wide range of uses.
- A motor setting can be selected between two. It is possible to select a base frequency, a voltage, an amount of torque boost, a thermal protection level, a stall operation level, a V/F pattern, and so on.
- The output frequency can be set within a range of up to 500Hz.

Complete with communications functions

- Terminal circuit boards are detachable and replaceable with a large variety of optional circuit boards.
- An RS485 communications circuit board is optionally available. It also suports Modbus RTU protocol.
- Optional software program enables you to set parameters using a personal computer, you can easily check, read, edit, write and save parameter settings.
- Using the block reading/writing function that was newly added to communications functions, you can issue a command or monitor the operating conditions more easily and more quickly.
- Communications circuit boards supporting DeviceNET, LonWorks, and so on are on the drawing board.

Easy-to-use operation panel — Names and functions

Full-scale



CHARGE lamp
Indicates that high voltage is still present within the inverter. Do not open the cover while this is lit.

Display
Displays the operation frequency, a parameter, a monitored item, the cause of a failure, and so on.

Percent (%) lamp
Lights when a numeric value is displayed in %.

RUN lamp
Lights when an ON command is issued but no frequency signal is sent out. It blinks when operation is started.

Hertz (Hz) lamp
Lights when a numeric value is displayed in Hz.

Built-in potentiometer lamp
Operation frequency can be changed when lighted.

PROGRAM lamp
Lights when the inverter is in parameter setting mode. This lamp blinks when the parameter "AUH" or "Gr.U" is selected.

MODE key
Displays operation frequency, parameters, and error causes.

MONITOR lamp
Lights when the inverter is in monitor mode. This lamp blinks when a detailed past trip record is displayed.

Enter key

Built-in potentiometer

Up key

Front panel locking screw
Allows you to lock and unlock the front panel easily.
Turn the screw 90° counterclockwise ↺ to unlock, or turn it 90° clockwise ↻ to lock the front panel.

Up/Down key lamp
Pressing up or down key when this lamp is lighted allows the setting of operation frequency.

RUN key lamp
Lights when the RUN key is enabled.

RUN key
Pressing this key while the RUN key lamp is lighted starts operation.

STOP key
Every pressing of this key while the RUN key lamp is will cause a slowdown stop.

Down key

Standard specifications

■3-phase 240V

Item		Specification										
Input voltage class		3-phase 240V										
Applicable motor (kW)		0.2	0.4	0.55	0.75	1.5	2.2	4.0	5.5	7.5	11	15
Rating	Type	VFS11										
	Form	2002PM	2004PM	2005PM	2007PM	2015PM	2022PM	2037PM	2055PM	2075PM	2110PM	2150PM
	Capacity (kVA) Note 1)	0.6	1.3	1.4	1.8	3.1	4.2	6.7	10	13	21	25
	Rated output current (A) Note 2)	1.5 (1.5)	3.3 (3.3)	3.7 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	17.5 (16.4)	27.5 (25.0)	33 (33)	54 (49)	66 (60)
	Output voltage Note 3)	3-phase 200V to 240V										
	Overload current rating	150%-60 seconds, 200%-0.5 second										
Power supply	Voltage-frequency	3-phase 200V to 240V - 50/60Hz										
	Allowable fluctuation	Voltage + 10%, -15% Note 4), frequency ±5%										
Protective method		IP20 Enclosed type (JEM1030)										
Cooling method		Self-cooling				Forced air-cooled						
Color		Munsel 5Y-8/0.5										
Built-in filter		Basic filter Note 5)										

■3-phase 500V

Item		Specification								
Input voltage class		3-phase 500V								
Applicable motor (kW)		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15
Rating	Type	VFS11								
	Form	4004PL	4007PL	4015PL	4022PL	4037PL	4055PL	4075PL	4110PL	4150PL
	Capacity (kVA) Note 1)	1.1	1.8	3.1	4.2	7.2	11	13	21	25
	Rated output current (A) Note 2)	1.5 (1.5)	2.3 (2.1)	4.1 (3.7)	5.5 (5.0)	9.5 (8.6)	14.3 (13.0)	17.0 (17.0)	27.7 (25.0)	33 (30)
	Output voltage Note 3)	3-phase 380V to 500V								
	Overload current rating	150%-60 seconds, 200% -0.5 second								
Power supply	Voltage-frequency	3-phase 380V to 500V - 50/60Hz								
	Allowable fluctuation	Voltage + 10%, -15% Note 4), frequency ±5%								
Protective method		IP20 Enclosed type (JEM1030)								
Cooling method		Forced air-cooled								
Color		Munsel 5Y-8/0.5								
Built-in filter		High-attenuation EMI filter Note 6)								

■1-phase 240V

Item		Specification				
Input voltage class		1-phase 240V				
Applicable motor (kW)		0.2	0.4	0.75	1.5	2.2
Rating	Type	VFS11S				
	Form	2002PL	2004PL	2007PL	2015PL	2022PL
	Capacity (kVA) Note 1)	0.6	1.3	1.8	3.1	4.2
	Rated output current (A) Note 2)	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)
	Output voltage Note 3)	3-phase 200V to 240V				
	Overload current rating	150%-60 seconds, 200%-0.5 second				
Power supply	Voltage-frequency	1-phase 200V to 240V – 50/60Hz				
	Allowable fluctuation	Voltage + 10%, -15% Note 4), frequency±5%				
Protective method		IP20 Enclosed type (JEM1030)				
Cooling method		Self-cooling			Forced air-cooled	
Color		Munsel 5Y-8/0.5				
Built-in filter		High-attenuation EMI filter Note 6)				

Note 1. Capacity is calculated at 220V for the 240V class and at 440V for the 500V class.

Note 2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4kHz or less.
When exceeding 4kHz, the rated output current setting is indicated in the parenthesis. When the input power voltage of the 400V class model exceeds 480V, it is necessary to further reduce the setting. The default setting of the PWM carrier Frequency is 12kHz.

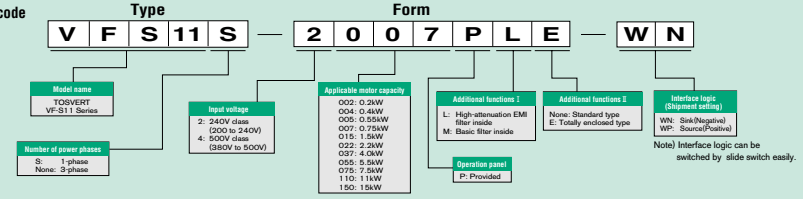
Note 3. Maximum output voltage is the same as the input voltage.

Note 4. ±10% when the inverter is used continuously (load of 100%).

Note 5. Built-in standard filter: Core and capacities
With RFI noise filter option: Complies EN55011 Class A Group 1 (Max.5m*) and Class B Group 1 (Max.1m*)
* Length of motor connecting cable.

Note 6. Built-in high-attenuation EMI filter:
Complies EN55011 Class A Group 1 (Max.5m*)
With RFI noise filter option: Complies EN55011 Class B Group 1 (Max.20m*) and Class A Group 1 (Max.50m*)
* Length of motor connecting cable.

Contents of the product code



Common specification

■Common specification

Item		Specification
Principal control functions	Control system	Sinusoidal PWM control
	Rated output voltage	Adjustable within the range of 50 to 600V by correcting the supply voltage (not adjustable above the input voltage)
	Output frequency range	0.5 to 500.0Hz, default setting: 0.5 to 80Hz, maximum frequency: 30 to 500Hz
	Minimum setting steps of frequency	0.1Hz: operation panel setting, 0.2Hz: analog input (when the max. frequency is 100Hz).
	Frequency accuracy	Digital setting: within ±0.01% of the max. frequency (-10 to +60°C) Analog setting: within ±0.5% of the max. frequency (25°C ±10°C)
	Voltage/frequency characteristics	V/f constant, variable torque, automatic torque boost, vector control, automatic energy-saving, dynamic automatic energy-saving control. Auto-tuning. Base frequency (25 - 500Hz) adjusting to 1 or 2, torque boost (0 - 30%) adjusting to 1 or 2, adjusting frequency at start (0.5 - 10Hz)
	Frequency setting signal	Potentiometer on the front panel, external frequency potentiometer (connectable to a potentiometer with a rated impedance of 1 - 10kΩ), 0 - 10Vdc (input impedance: VIA/VIB=30kΩ), 4 - 20mAdc (Input impedance: 250Ω).
	Terminal board base frequency	The characteristic can be set arbitrarily by two-point setting. Possible to set individually for three functions: analog input (VIA and VIB) and communication command.
	Frequency jump	Three frequencies can be set. Setting of the jump frequency and the range.
	Upper- and lower-limit frequencies	Upper-limit frequency: 0 to max. frequency, lower-limit frequency: 0 to upper-limit frequency
	PWM carrier frequency	Adjustable within a range of 2.0 to 16.0Hz (default: 12kHz).
	PID control	Setting of proportional gain, integral gain, differential gain and control wait time. Checking whether the amount of processing amount and the amount of feedback agree.
Operation specifications	Acceleration/deceleration time	Selectable from among acceleration/deceleration times 1, 2 or 3 (0.0 to 3200 sec.). Automatic acceleration/deceleration function. S-pattern 1 or 2, and S-pattern value adjustable. Forced rapid deceleration and dynamic rapid deceleration function.
	DC braking	Braking start-up frequency: 0 to maximum frequency, braking rate: 0 to 100%, braking time: 0 to 20 seconds, emergency DC braking, motor shaft fixing control
	Dynamic braking	Control and drive circuit is built in the inverter with the braking resistor outside (optional).
	Input terminal function (programmable)	Possible to select from among 65 functions, such as forward/reverse run signal input, jog run signal input, operation base signal input and reset signal input, to assign to 8 input terminals. Logic selectable between sink and source.
	Output terminal functions (programmable)	Possible to select from among 58 functions, such as upper/lower limit frequency signal output, low speed detection signal output, specified speed reach signal output and failure signal output, to assign to FL relay output, open collector output and RY output terminals.
	Forward/reverse run	The RUN and STOP keys on the operation panel are used to start and stop operation, respectively. The switching between forward run and reverse run can be done from one of the three control units: operation panel, terminal board and external control unit.
	Jog run	Jog mode, if selected, allows jog operation from the operation panel or the terminal board.
	Preset speed operation	Base frequency + 15-speed operation possible by changing the combination of 4 contacts on the terminal board.
	Retry operation	Capable of restarting automatically after a check of the main circuit elements in case the protective function is activated. 10 times (Max.) (selectable with a parameter)
	Various prohibition settings	Possible to write-protect parameters and to prohibit the change of panel frequency settings and the use of operation panel for operation, emergency stop or resetting.
	Regenerative power ride-through control	Possible to keep the motor running using its regenerative energy in case of a momentary power failure.
	Auto-restart operation	In the event of a momentary power failure, the inverter reads the rotational speed of the coasting motor and outputs a frequency appropriate to the rotational speed in order to restart the motor smoothly. This function can also be used when switching to commercial power.
	Drooping function	When two or more inverters are used to operate a single load, this function prevents load from concentrating on one inverter due to unbalance.
	Override function	The sum of two analog signals (VIA/VIB) can be used as a frequency command value.
	Failure detection signal	1c-contact output: (250Vac-0.5A-cos ϕ =0.4)
Protective function	Protective function	Stall prevention, current limitation, over-current, output short circuit, over-voltage, over-voltage limitation, undervoltage, ground fault, power supply phase failure, output phase failure, overload protection by electronic thermal function, armature over-current at start-up, load side over-current at start-up, over-torque, undercurrent, overheating, cumulative operation time, life alarm, emergency stop, braking resistor over-current/overload, various pre-alarms
	Electronic thermal characteristic	Switching between standard motor and constant-torque VF motor, switching between motors 1 and 2, setting of overload trip time, adjustment of stall prevention levels 1 and 2, selection of overload stall
	Reset function	Function of resetting by closing contact 1a or by turning off power or the operation panel. This function is also used to save and clear trip records.
Display function	Alarms	Stall prevention, overvoltage, overload, under-voltage, setting error, retry in process, upper/lower limits
	Causes of failures	Over-current, overvoltage, overheating, short-circuit in load, ground fault, overload on inverter, over-current through arm at start-up, over-current through load at start-up, CPU fault, EEPROM fault, RAM fault, ROM fault, communication error. (Selectable: Over-current through braking resistor/overload, emergency stop, under-voltage, low voltage, over-torque, motor overload, output open-phase)
	Monitoring function	Operation frequency, operation frequency command, forward/reverse run, output current, voltage in DC section, output voltage, torque, torque current, load factor of inverter, integral load factor of PBR, input power, output power, information on input terminals, information on output terminals, version of CPU1, version of CPU2, version of memory, PID feedback amount, frequency command (after PID), integral input power, integral output power, rated current, causes of past trips 1 through 4, information on life alarm, cumulative operation time
	Past trip monitoring function	Stores data on the past four trips: number of trips that occurred in succession, operation frequency, direction of rotation, load current, input voltage, output voltage, information on input terminals, information on output terminals, and cumulative operation time when each trip occurred.
	Output for frequency meter	Analog output (1mAdc full-scale DC ammeter or 7.5Vdc full-scale DC voltmeter/rectifier type AC voltmeter, 4 to 20mA/0 to 20mA output)
	4-digit 7-segments LED	Frequency: inverter output frequency. Alarm: stall alarm “C”, overvoltage alarm “P”, overload alarm “L”, overheat alarm “H”. Status: inverter status (frequency, cause of activation of protective function, input/output voltage, output current, etc.) and parameter settings. Free-unit display: arbitrary unit (e.g. rotating speed) corresponding to output frequency.
	Indicator	Lamps indicating the inverter status by lighting, such as RUN lamp, MON lamp, PRG lamp, % lamp, Hz lamp, frequency setting potentiometer lamp, UP/DOWN key lamp and RUN key lamp. The charge lamp indicates that the main circuit capacitors are electrically charged.
Environments	Use environments	Indoor, altitude: 1000m (Max.), not exposed to direct sunlight, corrosive gas, explosive gas / vibration (less than 5.9m/s^2) (10 to 55Hz)
	Ambient temperature	-10 to +60°C Note)1.2
	Storage temperature	-25 to +70°C
	Relative humidity	20 to 93% (free from condensation and vapor).

Note 1. Above 40°C : Remove the protective seal from the top of the inverter.
Above 50°C: Remove the seal from the top of the inverter and use the inverter with the rated output current reduced.

Note 2. If inverters are installed side by side (with no sufficient space left between them) installation: Remove the seal from the top of each inverter.
When installing the inverter where the ambient temperature will rise above 40°C, remove the seal from the top of the inverter and use the inverter with the rated output current reduced.

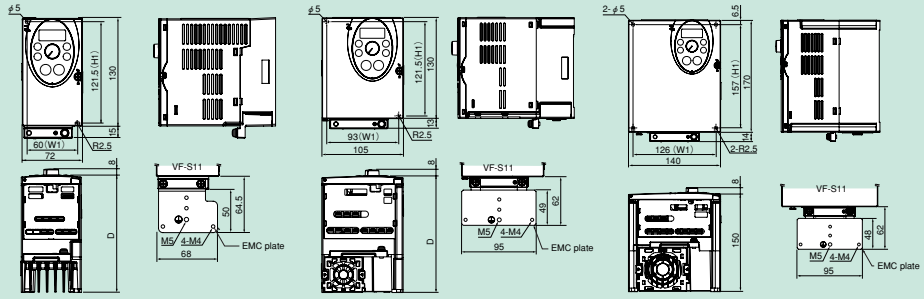


Fig. A

Fig. B

Fig. C

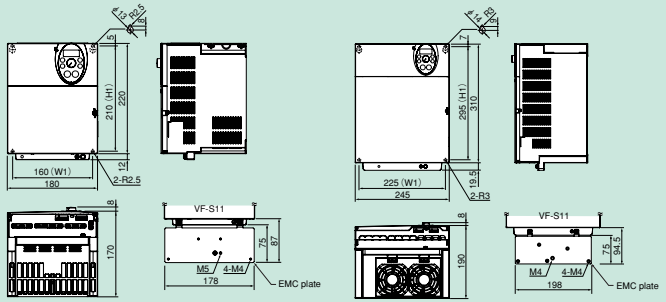


Fig. D

Fig. E

Note 1. To make it easier to grasp the dimensions of each inverter, dimensions common to all inverters in these figures are shown with numeric values but not with symbols.
Here are the meanings of the symbols used.

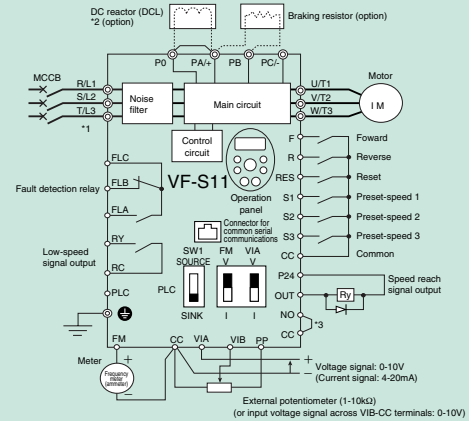
W: Width
H: Height
D: Depth
W1: Mounting dimension (horizontal)
H1: Mounting dimension (vertical)
H2: Height of EMC plate mounting area
D2: Height of frequency setting knob

Note 2. Here are the optionally available EMC plate
Fig. A : EMP003Z
Fig. B, Fig. C: EMP004Z
Fig. D : EMP005Z
Fig. E : EMP006Z

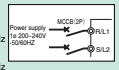
Input voltage	Applicable motor (kW)	Type	Dimensions (mm) W	H	D	W1	H1	H2	D2	Drawing	Approx. weight (kg)
3-phase 240V	0.2	VFS11-2002PM	72	130	120	60	121.5	15	8	A	0.9
	0.4	VFS11-2004PM									0.9
	0.55	VFS11-2005PM			130						1.1
	0.75	VFS11-2007PM									1.1
	1.5	VFS11-2015PM	105	130	130	93	121.5	13		B	1.2
	2.2	VFS11-2022PM			150						1.3
	4.0	VFS11-2037PM	140	170	150	126	157	14		C	2.2
	5.5	VFS11-2055PM	180	220	170	160	210	12		D	4.8
	7.5	VFS11-2075PM									4.9
	11	VFS11-2110PM	245	310	190	225	295	19.5		E	9.3
	15	VFS11-2150PM									9.6
3-phase 500V	0.4	VFS11-4004PL	105	130	150	93	121.5	13	8	B	1.4
	0.75	VFS11-4007PL									1.5
	1.5	VFS11-4015PL									1.5
	2.2	VFS11-4022PL	140	170	150	126	157	14		C	2.3
	4.0	VFS11-4037PL									2.5
	5.5	VFS11-4055PL	180	220	170	160	210	12		D	5.0
	7.5	VFS11-4075PL									5.1
	11	VFS11-4110PL	245	310	190	225	295	19.5		E	9.6
	15	VFS11-4150PL									9.6
1-phase 240V	0.2	VFS11S-2002PL	72	130	130	60	121.5	15	8	A	1.0
	0.4	VFS11S-2004PL									1.0
	0.75	VFS11S-2007PL			140						1.2
	1.5	VFS11S-2015PL	105	130	150	93	121.5	13		B	1.4
	2.2	VFS11S-2022PL	140	170	150	126	157	14		C	2.2

Standard connection diagram

Sink (Negative) logic : common = CC

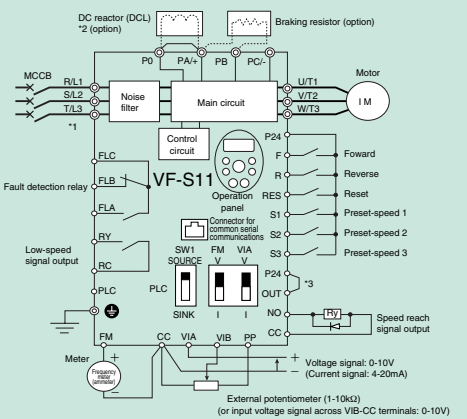


Main circuit power supply
240V class: three-phase 200-240V -50/60Hz
500V class: three-phase 380-500V -50/60Hz

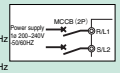


*1: The T/L3 terminal not provided for signal-phase models.
Use the R/L1 and S/L2 terminal as input terminals.
*2: The inverter came with the PO and the PA/+ terminals shorted by means of a shoeting bar.
Before installing the DC reactor (DCL), remove the bar.
*3: When using the OUT output terminal in sink logic mode, short-circuit the NO and CC terminals.

Source (Positive) logic : common = P24



Main circuit power supply
240V class: three-phase 200-240V -50/60Hz
500V class: three-phase 380-500V -50/60Hz



*1: The T/L3 terminal not provided for signal-phase models.
Use the R/L1 and S/L2 terminal as input terminals.
*2: The inverter came with the PO and the PA/+ terminals shorted by means of a shoeting bar.
Before installing the DC reactor (DCL), remove the bar.
*3: When using the NO output terminal in source logic mode, short-circuit the P24 and OUT terminals.

wiring devices

Voltage class	Capacity applicable motor (kW)	Interver model	Molded-case circuit breaker (MCCB) Earth leakage circuite breaker(ELCB) Rated current(A)	Magnetic contactor (MC) Rated current(A)	Overload relay (Th-Ry) Adjusted current (A) (For reference)	Wire size (mm²) Main circuit (mm²) Note 4)	DC reactor (optional)(mm²)	Braking resistor (optional)(mm²)	Grounding cable (mm²)Note 6)
3-phase 240V class	0.2	VFS11-2002PM	5	11	1.3	2.0	1.25	2.0	3.5
	0.4	VFS11-2004PM	5	11	2.3	2.0	1.25	2.0	3.5
	0.55	VFS11-2005PM	10	11	2.7	2.0	2.0	2.0	3.5
	0.75	VFS11-2007PM	10	11	3.6	2.0	2.0	2.0	3.5
	1.5	VFS11-2015PM	15	11	6.8	2.0	2.0	2.0	3.5
	2.2	VFS11-2022PM	20	13	9.3	2.0	2.0	2.0	3.5
	4.0	VFS11-2037PM	30	26	15	3.5	3.5	2.0	3.5
	5.5	VFS11-2055PM	50	35	22	5.5	8	5.5	5.5
	7.5	VFS11-2075PM	60	50	28	8.0	14	5.5	8.0
	11	VFS11-2110PM	100	65	44	14	14	5.5	14
	15	VFS11-2150PM	125	80	57	22	22	5.5	22
3-phase 500V class	0.4	VFS11-4004PL	5	9	1.0	2.0	2.0	2.0	3.5
	0.75	VFS11-4007PL	5	9	1.6	2.0	2.0	2.0	3.5
	1.5	VFS11-4015PL	10	9	3.6	2.0	2.0	2.0	3.5
	2.2	VFS11-4022PL	15	9	5.0	2.0	2.0	2.0	3.5
	4.0	VFS11-4037PL	20	13	6.8	2.0	2.0	2.0	3.5
	5.5	VFS11-4055PL	30	17	11	2.0	3.5	2.0	3.5
	7.5	VFS11-4075PL	30	25	15	3.5	5.5	2.0	3.5
	11	VFS11-4110PL	50	33	22	5.5	8.0	2.0	5.5
	15	VFS11-4150PL	60	48	28	8.0	14	2.0	8.0
1-phase 240V class	0.2	VFS11S-2002PL	10	11	1.3	2.0	2.0	2.0	3.5
	0.4	VFS11S-2004PL	15	11	2.3	2.0	2.0	2.0	3.5
	0.75	VFS11S-2007PL	20	11	3.6	2.0	2.0	2.0	3.5
	1.5	VFS11S-2015PL	30	18	6.8	2.0	2.0	2.0	3.5
	2.2	VFS11S-2022PL	40	35	9.3	2.0	3.5	2.0	5.5

Note) 1. Be sure to attach surge killer to the exciting coil of the relay and the magnetic contactor.
2. 500V class: For the operation and control circuit, regulate the voltage at 240V or less with a step-down transformer.
3. When using the auxiliary contacts 2a of the magnetic contactor MC for the control circuit, connect the contacts 2a in parallel to increase reliability.

Note) 4. Size of the wires conected to the input terminals R, S and T and the output terminals U, V and W when the length of each wire does not exceed 30m.
5. For the control circuit, use shielded wires 0.75 mm² or more in diameter.
6. For grounding, use a cable with a size equal to or larger than the above.
7. The wire sizes specified in the above table apply to HIV wires (cupper wires shielded with an insulator with a maximum allowable temperature of 75°C) used at an ambient temperature of 50°C or less.

Terminal Functions

Main circuit teminal functions

Terminals symbol	Terminal function
⏚	Grounding terminal for connecting inverter. There are 3 terminals in total. 2 terminals in the terminal board, 1 terminal in the cooling fin.
R/L1, S/L2, T/L3	240V class: single-phase 200~240V-50/60Hz * Single-phase input: R/L1 and S/L2 terminals three-phase 200~240V-50/60Hz 500V class: three-phase 380~500V-50/60Hz
U/T1, V/T2, W/T3	Connect to a (three-phase induction) motor.
PA/+, PB	Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.
PC/−	This is a negative potential terminal in the internal DC main circuit. DC common power can be input across the PA/+ terminals (positive potential).
PO, PA/+	Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a short bar when shipped from the factory. Before installing DCL, remove the short bar.

Control circuit terminal functions

Terminal symbol	Function		Electrical specifications	Wire size
F	Multifunction programmable contact input	Shorting across F-CC causes forward rotation; open causes slowdown and stop.	Dry contact input 24Vdc - 5mA or less *Sink/Source/ PLC selectable using SW	Solid wire : 0.3 to 1.5 (mm²) Stranded wire : 0.3 to 1.5 (mm²) (AWG22 to 16) Sheath strip length : 6 (mm) Screwdriver: Small-sized flat-blade screwdriver Blade thickness: 0.4 mm or less Blade width: 2.5 mm or less
R		Shorting across R-CC causes reverce rotation; open causes slowdown and stop.		
RES		Shorting across RES-CC causes a held reset when the inverter protector function is operating. Note that when the inverter is operating normally, it will not operate even if there is a short across RES-CC.		
S1		Shorting across S1-CC causes preset speed operation.		
S2		Shorting across S2-CC causes preset speed operation.		
S3		Shorting across S3-CC causes preset speed operation.		
PLC	External 24Vdc power input		(Insulation resistance: 50Vdc)	
CC	Control circuit's equipotential terminal (sink logic).3 common terminals for input/output.			
PP	Power output for analog input setting.		10Vdc (permissible load current: 10mAdc)	
VIA Note 1)	Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0-60Hz frequency. The function can be changed to 4-20 mAdc (0-20 mA) current input by flipping the VIA slide switch to the I position.		10Vdc (internal impedance: 30kΩ) 4~20mA (Internal impedance: 250Ω)	
VIB Note 1)	Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0-50Hz (50Hz setting) or 0-60Hz (60Hz setting) frequency.		10Vdc (internal impedance: 30kΩ)	
FM	Multifunction programmable analog output. Standard default setting: output frequency. Connect a 1mAdc full-scale ammeter or 7.5Vdc (10Vdc)-1mA full-scale voltmeter. The function can be changed to 0-20mAdc (4-20mA) current output by flipping the FM slide switch to the I position.		1mA full-scale DC ammeter or 7.5Vdc 1mA full-scale DC voltmeter 0-20mA (4-20mA) full-scale DC ammeter	
P24	When the source logic is used, a common terminal 24Vdc is connected.		24Vdc - 100mA	
OUT NO Note 2)	Multifunction programmable open collector output. Standard default settings detect and output speed reach signal output frequencies. The NO terminal is an isoelectric output terminal. It is insulated from the CC terminal. These terminals can also be used as multifunction programmable pulse train output terminals.		Open collector output: 24Vdc - 50mA Pulse train output 10mA or more	
RC RY Note 2)	Multifunction programmable relay contact output. Contact ratings: 250Vac - 2A (cosø = 1), 30Vdc - 1A, 250Vac - 1A (cosø = 0.4). Standard default settings detect and output low-speed signal output frequencies.		250Vac - 1A: at resistance load 30Vdc - 0.5A, 250Vac - 0.5A (cosø = 0.4)	
FLA FLB FLC	Multifunction programmable relay contact output. Contact ratings: 250Vac-1A (cosø = 1), 30Vdc-0.5A, 250Vac-0.5A (cosø = 0.4). Detects the opertion of the inverter's protection function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.		250Vac - 1A: at resistance load 30Vdc - 0.5A, 250Vac - 0.5A (cosø = 0.4)	

Note 1: By changing parameter setting, this terminal can also be used as a multifunction programmable contact input terminal.
When the inverter is used in a sink logic configuration, a resistor (4.7kΩ at 0.5W) should be inserted between the P24 and VIA/VIB terminals.
Also, the slide switch for the VIA terminal needs to be turned to the V position.

Note 2: Multifunction output terminals to which two different functions can be assigned.

Function Description

What are parameters?

Each "setting item" that determines the control (operation) of an inverter is called a parameter.
For example, the connection meter selection parameter (title FMSL) is adjusted to set the connection meter, the acceleration time parameter (title ACC) is adjusted to change the acceleration time, and the maximum frequency parameter (title FH) is adjusted to modify the maximum frequency.
For the function you want to use, check the necessary parameter(s).

Basic parameters

●Operation frequency parameter

Title	Function	Adjustment range	Default setting	Remarks
FC	Operation frequency of operation panel	LL – UL	0.0	

●Four automatic functions

Title	Function	Adjustment range	Default setting	Remarks
AUH	History function	Displays parameters in groups of five in the reverse order to that in which their settings were changed. * (Possible to edit)	—	
AU1	Automatic acceleration/ deceleration	0: Disabled (manual) 1: Automatic 2: Automatic (only at acceleration)	0	
AU2	Automatic torque boost	0: Disabled 1: Automatic torque boost + auto-tuning 2: Vector control + auto-tuning 3: Energy saving + auto-tuning	0	
AU4	Automatic function setting	0: Disabled 1: Coast stop 2: 3-wire operation 3: External input UP/DOWN setting 4: 4-20 mA current input operation	0	

●Other basic parameters

Title	Function	Adjustment range	Default setting	Remarks
CMOD	Command mode selection	0: Terminal board 1: Operation panel	1	
FMOD	Frequency setting mode selection 1	0: Built-in potentiometer 1: VIA 2: VIB 3: Operation panel 4: Serial communication 5: UP/DOWN from external contact 6: VIA + VIB (Override)	0	
FMSL	Meter selection	0: Output frequency 1: Output current 2: Set frequency 3: DC voltage 4: Output voltage command value 5: Input power 6: Output power 7: Torque 8: Torque current 9: Motor cumulative load factor 10: Inverter cumulative load factor 11: PBR (braking reactor) cumulative load factor 12: Frequency setting value (after PID) 13: VIA Input value 14: VIB Input value 15: Fixed output 1 (Output current: 100%) 16: Fixed output 2 (Output current: 50%) 17: Fixed output 3 (Other than the output current: 100%) 18: Serial communication data 19: For adjustments (FM set value is displayed.)	0	
FM	Meter adjustment	—	—	

Title	Function	Adjustment range	Default setting	Remarks
TYP	Default setting	0: - 1: 50Hz default setting 2: 60Hz default setting 3: Default setting (Initialization) 4: Trip record clear 5: Cumulative operation time clear 6: Initialization of type information 7: Save user-defined parameters 8. Call user-defined parameters 9. Cumulative fan operation time re-cord clears	0	
FR	Forward/reverse run selection (Operation panel)	0: Forward run 1: Reverse run 2: Forward run (F/R switching possi-ble) 3: Reverse run (F/R switching possi-ble)	0	
ACC	Acceleration time 1	0.0–3200(s)	10.0	
DEC	Deceleration time 1	0.0–3200(s)	10.0	
FH	Maximum frequency	30.0–500.0(Hz)	80.0	
UL	Upper limit frequency	0.5– FH (Hz)	50(WP) 60(WN)	
LL	Lower limit frequency	0.0– UL (Hz)	0.0	
UL	Base frequency 1	25–500.0(Hz)	50(WP) 60(WN)	
VLV	Base frequency voltage 1	50-330 (240V class) (V) 50-660 (500V class) (V)	230/ 460	
PT	V/F control mode selection 1	0: V/F constant 1: Variable torque 2: Automatic torque boost control 3: Vector control 4: Automatic energy-saving 5: Dynamic automatic energy-saving (for fans and pumps) 6: PM motor control	2	
VB	Torque boost value 1	0.0–30.0(%)	Depends on the capacity	
THR	Motor electronic-thermal protection level 1	10–100(%/A)	100	
OLN	Electronic-thermal protection characteristic selection *2	Setting / Type / Overload protection / OL stall: 0 Standard motor Valid Invalid 1 Standard motor Valid Valid 2 Standard motor Invalid Invalid 3 Standard motor Invalid Valid 4 VF motor (Special motor) Valid Invalid 5 VF motor (Special motor) Valid Valid 6 VF motor (Special motor) Invalid Invalid 7 VF motor (Special motor) Invalid Valid	0	
SP1 to SP7	Preset-speed operation frequency 1~7	LL – UL (Hz)	0.0	
F---	Extended parameters	—	—	
CR.U	Automatic edit function	—	—	

To **Extended parameters** Nearly 200 parameters

For further information about extended parameters, refer to the Toshiba Schneider Inverter Corporation Web page:
http://www.inverter.co.jp/

How to read the monitor display?

Monitor display

The LEDs on the operation panel display the following symbols to indicate operations and parameters.

LED (number)

0	1	2	3	4	5	6	7	8	9	–
0	1	2	3	4	5	6	7	8	9	–

LED (alphabet)

Aa	Bb	C	c	Dd	Ee	Ff	Gg	H	h	I	i	Jj	Kk	Ll
A	b	C	c	d	E	F	G	H	h	I	i	J	/	L

Mm	Nn	O	o	Pp	Qq	Rr	Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz
n	n	o	o	P	q	r	S	t	U	u	/	/	y	/

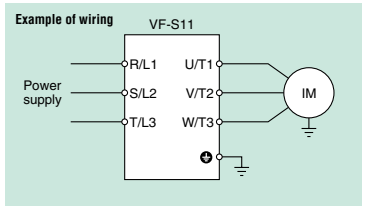
Q & A

Q1 How can I use the inverter immediately?

A1 Just connect the power supply and the motor, and you can use this inverter series immediately.

You can use the RUN and STOP keys and the frequency setting potentiometer to easily operate the inverter. You can also make adjustments easily using the automatic setting functions.

- **Automatic acceleration/deceleration:** Automatically adjusting acceleration or deceleration time according to the load.
- **Automatic torque increase:** Automatically improving the motor torque according to the load.
- **Automatic function setting:** Selecting the inverter operation method.



Q2 What can I do if I forget what I have programmed?

A2 The inverter includes the capability of searching for changed settings. Also, you the inverter can be reset to its default settings by following the steps below.(User parameter group)

(1) Change setting retrieval (**Cr.U**): Automatically retrieves and displays only the parameters differing from the default setting. You can confirm the changed parameters.

(2) Standard default setting: By setting the parameter **tYP** to **3**, all parameters can be returned to the those factory default settings. (Except parameters **Fr**, **FrSL**, **F109**, **F710**-**F713**, **F669**,and **F880**)

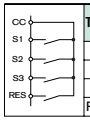
(3) Saving/invoking a user-defined setting: To save a parameter setting you have made, set the parameter **tYP** to **1**. To return a parameter setting you changed to its original setting you saved as a default, set the parameter **tYP** to **8**.

Q3 How can I change the frequency by contact input in combination with a PLC (programmable controller)?

A3 Incorporating a standard 15-step speed function, this inverter series allows you to change the frequency by setting parameters and using contact input.

Multi-step contact input signal samples

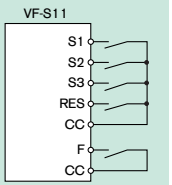
○ : ON – : OFF (Speed command other than a preset-speed becomes effective when all contacts are OFF.)



Terminal	Preset-speed														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S1-CC	○	–	○	–	○	–	○	–	○	–	○	–	○	–	○
S2-CC	–	○	○	–	–	○	○	–	–	○	○	–	–	○	○
S3-CC	–	–	–	○	○	○	○	–	–	–	–	○	○	○	○
RES-CC	–	–	–	–	–	–	–	○	○	○	○	○	○	○	○

You can change the frequency using contact input.

Parameter	Setting
Sr 1 (Preset-speed operation frequency1)	Lower limit frequency-Upper limit frequency
:	:
Sr 7 (Preset-speed operation frequency7)	Lower limit frequency-Upper limit frequency
F287 (Preset-speed operation frequency8)	Lower limit frequency-Upper limit frequency
:	:
F294 (Preset-speed operation frequency15)	Lower limit frequency-Upper limit frequency
F114 (Input terminal Selection4)	**6** (Preset-speed command 1)
F115 (Input terminal Selection5)	**7** (Preset-speed command 2)
F116 (Input terminal Selection6)	**8** (Preset-speed command 3)
F113 (Input terminal Selection3)	**9** (Preset-speed command 4)



Q4 How can I get a large torque?

A4 This inverter series ensures a torque of 200% or more from low speeds by utilizing Toshiba's sensorless vector control.

Enable the sensorless vector control for a load that requires high starting or low speed torque.

You need to set the following 3 parameters first.

F415 : Motor rated current (A)
F416 : Motor no-load current (%)
F417 : Motor rated speed (min^{-1})

To use sensorless vector control

1. When automatic torque increase **AU2** = **1** is set, all the sensorless vector controls and motor constants are set at one time.
2. Set V/F control mode selection **Pt** = **3** (Vector control). Set the motor constant.

(1) For the same capacity as the inverter with the 4P Toshiba standard motor, it is not necessary to set the motor constants.

(2) Autotuning **F400** = **2**
When the inverter is operated for the first time after auto tuning, a motor constant can be set automatically.

(3) The motor can be operated with higher accuracy by setting the following constants:

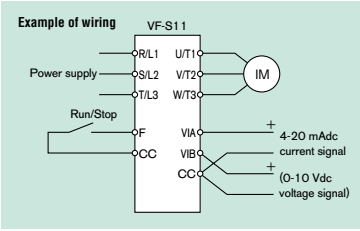
F401 : Slip frequency gain (%)
F402 : Automatic torque boost value (%)
F418 : Speed control response coefficient
F419 : Speed control stability coefficient

Q5 How do I start/stop a motor by external contacts, and control the frequency by a current signal or a voltage signal.

A5 To control the inverter by external contacts and a analog signal. (4-20mA or 0-10Vdc signal)

■ **Parameters to be changed**

Parameter	Setting
CNOd (Command mode selection)	0 (Terminal board)
FNOd (Frecuency setting mode selection)	1 (VIA) or 2 (VIB)



■ **CNOd (Command mode selection) is a parameter to determine the source of the operation signal.**
For performing run/stop through a terminal → set to 0 (terminal board).
For performing run/stop with RUN/STOP key on the panel → set to 1 (panel).

■ **FNOd (Frequency setting mode selection) is a parameter to determine the place for providing frequency command.**

Set the parameter to 1 to issue a frequency command by means of a current (voltage signal) from the VIA terminal, or set it to 2 to issue a frequency command by means of a voltage signal from the VIB terminal.
→ To be set on 0 (Built-in potentiometer).

Q6 Why do other devices malfunction due to noise?

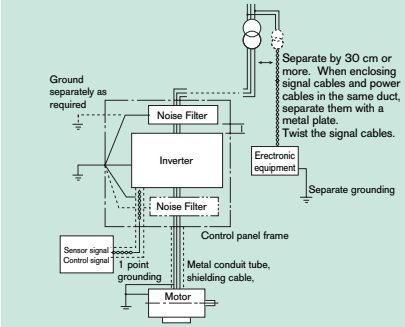
A6 Using PWM control, this inverter series generates noise that may affect nearby instrumentation and electronic equipment.

Noise is classified by propagation route into transmission noise, and radiation noise.
Take the following counter measures for noise which affects other equipment:

- Separate the signal cables from the power cables with sufficient distance.
- Install noise filters.

※For noise reduction, every VF-S11 series of inverter comes standard with a noise filter built in on the input side.

- Use twisted-pair shielding cables for weak electric circuits and signal circuits, and be sure to ground one end of the shielding.
- Install the inverters separately from other equipment.
- Cover the inverters and their cables with metal conduit tubes and metal control panels, and ground these covers.
- EMC plate is attached for measures of radiation noise.



To users of our inverters

When studying how to use our inverters

Notes

Leakage current

This inverter uses high-speed switching devices for PWM control.
When a relatively long cable is used for power supply to an inverter, current may leak from the cable or the motor to the ground because of its capacitance, adversely affecting peripheral equipment. The intensity of such a leakage current depends on the PWM carrier frequency, the lengths of the input and output cables, etc., of the inverter. To prevent current leakage, it is recommended to take the following measures.

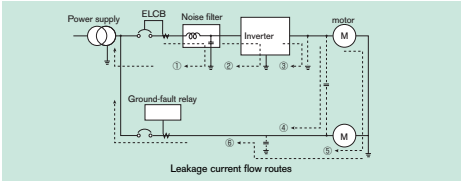
[Effects of leakage current]

Leakage current which increases when an inverter is used may pass through the following routes:

Route (1) ... Leakage due to the capacitance between the ground and the noise filter
Route (2) ... Leakage due to the capacitance between the ground and the inverter
Route (3) ... Leakage due to the capacitance between ground and the cable connecting the inverter and the motor
Route (4) ... Leakage due to the capacitance of the cable connecting the motor and an inverter in another power distribution line
Route (5) ... Leakage through the grounding line common to motors
Route (6) ... Leakage to another line because of the capacitance of the ground

Leakage current which passes through the above routes may cause the following trouble.

- Malfunction of a leakage circuit breaker in the same or another power distribution line
- Malfunction of a ground-relay installed in the same or another power distribution line
- Noise produced at the output of an electronic device in another power distribution line
- Activation of an external thermal relay installed between the inverter and the motor, at a current below the rate current



Leakage current flow routes

[Measures against effects of leakage current]

The measures against the effects of leakage current are as follows:

1) Measures to prevent the malfunction of leakage circuit breakers
   (1) Decrease the PWM carrier frequency of the inverter. This inverter allows you to decrease the frequency up to 2.0kHz. Note)
   (2) Use radio-frequency interference-proof ELCBs (manufactured by Toshiba Schneider Inverter Corporation) as ground-fault interrupters in not only the system into which the inverter is incorporated but also other systems. When ELCBs are used, the PWM carrier frequency needs to be increased to operate the inverter.
   (3) When connecting multiple inverters to a single ELCB, use an ELCB with a high current sensitivity or reduce the number of inverters connected to the ELCB.
2) Measures against malfunction of ground-fault relay:
   (1) Decrease the PWM carrier frequency of the inverter. This inverter allows you to decrease the frequency up to 2.0kHz. Note)
   (2) Install ground-fault relays with a high-frequency protective function (e.g., Toshiba CCR12 type of relays) in both the same and other lines. When ELCBs are used, the PWM carrier frequency needs to be increased to operate the inverter.
3) Measures against noise produced by other electric and electronic systems:
   (1) Separate the grounding line of the inverter from that of the affected electric and electronic systems.
   (2) Decrease the PWM carrier frequency of the inverter. This inverter allows you to decrease the frequency up to 2.0kHz. Note)
4) Measures against malfunction of external thermal relays:
   (1) Remove the external thermal relay and use the electronic thermal function of the inverter instead of it. (Unapplicable to cases where a single inverter is used to drive more than one motor. Refer to the instruction manual for measures to be taken when thermal relays cannot be removed.)
   (2) Decrease the PWM carrier frequency of the inverter. This inverter allows you to decrease the frequency up to 2.0kHz. Note)

Note) If the carrier frequency reduce, the acoustic noise caused by the motor increase.

5) Measures by means of wiring and grounding
   (1) Use a grounding wire as large as possible.
   (2) Separate the inverter's grounding wire from that of other systems or install the grounding wire of each system separately to the grounding point.
   (3) Ground (shield) the main circuit wires with metallic conduits.
   (4) Use the shortest possible cables to connect the inverter to the motor.
   (5) If the inverter has a high-attenuation EMI filter, turn off the grounding capacitor detachment switch to reduce the leakage current. Note that doing so leads to a reduction in the noise attenuating effect.

Ground fault

Before begining operation, thoroughly check the wiring between the motor and the inverter for incorrect wiring or short circuits. Do not ground the neutral point of any star-connected motor.

Radio interference

The inverter may cause radio-frequency interference if an audio system is installed in proximity to it. In the event of radio-frequency interference, its effects can be reduced by inserting a noise suppressing filter (optional) on the power supply side of the inverter or by shielding the motor connecting cables with conduits or the like. Contact us for further information.

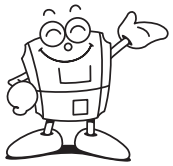
Power factor improvement capacitors

Do not install a power factor improvement capacitors on the input or output side of the inverter.
Installing a power factor improvement capacitor on the input or output side causes current containing harmonic components to flow into the capacitor, adversely affecting the capacitor itself or causing the inverter to trip. To improve the power factor, install an input AC reactor or a DC reactor (optional) on the primary side of the inverter.

Installation of input AC rectors

These devices are used to improve the input power factor and suppress high harmonic currents and surges. Install an input AC reactor when using this inverter under the following conditions:

(1) When the power source capacity is 200kVA or more, and when it is 10 times or more greater than the inverter capacity.
(2) When the inverter is connected the same power distribution system as a thyristor-committed control equipment.
(3) When the inverter is connected to the same power distribution system as that of distorted wave-producing systems, such as arc furnaces and large-capacity inverters.



When wiring the inverter

Wiring precautions

Installing a molded-case circuit breaker [MCCB]

(1) Install a molded-case circuit breaker (MCCB) on the inverter's power supply input to protect the wiring.
(2) Avoid turning the molded-case circuit breaker on and off frequently to turn on/off the motor.
(3) To turn on/off the motor frequently, close/break the control terminals F (or R)-CC.

Installing a magnetic contactor [MC] [primary side]

(1) To prevent an automatic restart after the power interruption or overload relay has tripped, or actuation of the protective circuit, install an electro-magnetic contact in the power supply.
(2) The inverter is provided with a failure detection relay (FL), so that, if its contacts are connected to the operation circuit of the magnetic contactor on the primary side, the magnetic contactor will be opened when the protective circuit of the inverter is activated.
(3) The inverter can be used without a magnetic contactor. In this case, use an MCCB (equipped with a voltage tripping device) for opening the primary circuit when the inverter protective circuit is activated.
(4) Avoid turning the magnetic contactor on and off frequently to turn on/off the motor.
(5) To turn on/off the motor frequently, close/break the control terminals F (or R)-CC.

Installing a magnetic contactor [MC] [secondary side]

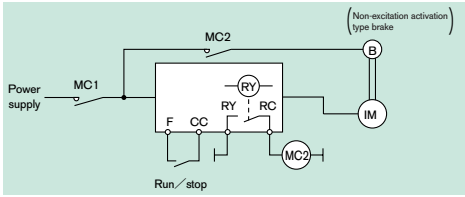
(1) As a rule, if a magnetic contactor is installed between the inverter and the motor, do not turn of ON/OFF while running. (If the secondary-side contactor is turned of ON/OFF while running, a large current may flow in the inverter, causing inverter damage and failure.)
(2) A magnetic contactor may be installed to change the motor or change to the commercial power source when the inverter is stopped. Always use an interlock with the magnetic contactor in this situation so that the commercial power supply is not applied to the inverter's output terminals.

External signal

(1) Use a relay rated for low currents. Mount a surge suppressor on the excitation coil of the relay.
(2) When wiring the control circuit, use shielded wires or twisted pair cables.
(3) Because all of the control terminals except FLA, FLB and FLC are connected to electronic circuits, insulate these terminals to prevent them from coming into contact with the main circuit.

Installing an overload relay

(1) The VF-S11 inverter has an electronic-thermal overload protective function. However, in the following cases, the thermal relay operation level must be adjusted or an overload relay matching the motor's characteristics must be installed between the inverter and the motor.
   (a) When using a motor having a rated current value different from that of the equivalent.
   (b) When driving several motors simultaneously.
(2) When using the inverter to control the operation of a constant-torque motor (VF motor), change the protective characteristic of the electronic thermal relay according to the setting of the VF motor.
(3) In order to adequately protect a motor used for low-speed operation, we recommend the use of a motor equipped with a embedded thermal relay.



When changing the motor speed

Application to standard motors

Vibration

When a motor is operated with an industrial inverter, it experiences more vibrations than when it is operated by the commercial power supply. The vibration can be reduced to a negligible level by securing the motor and machine to the base firmly. If the base is weak, however, the vibration may increase at a light load due to resonance with the mechanical system.

Reduction gear, belt, chain

Note that the lubrication capability of a reducer or a converter used as the interface of the motor and the load machine may affected at low speeds.
When operating at a frequencies exceeding 60 Hz or higher, power transmission mechanisms such as reduction gear, belts and chains, may cause problems such as production of noise, a reduction in strength, or shortening of service life.

Frequency

Before setting the maximum frequency to 60 Hz or higher, confirm that this operating range is acceptable for the motor.

Application to special motors

Gear motor

When using an industrial inverter to drive a gear motor, inquire of the motor manufacturer about its continuous operation range, since low-speed operation of a gear motor may cause insufficient lubrication.

Toshiba Gold Motor (High-efficiency power-saving motor)

Inverter-driven operation of Toshiba Gold Motors is the best solution for saving energy. This is because these motors have improved efficiency, power factor, and noise/vibration reduction characteristics when compared to standard motors.

Pole-changing motor

Pole-changing motors can be driven by this inverter. Before changing poles, however, be sure to let the motor come to a complete stop.

Hight-pole-count motors

Note that hight-pole count motors(8 or more poles), which may be used for fans,etc., have higher rated current than 4-pole moters.
The current ratings of multipole motors are relatively high. So, when selecting an inverter, you must pay special attention to its current rating so that the current rating of the motor is below that of the inverter.

Single-phase motor

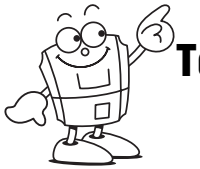
Because single-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter. If only a single-phase, power system is availabls a 3-phase motor can be driven by using a single-phase input interter to convert it into a 3-phase 200V output. (A special inverter and a 3-phase motor are required.)

Braking motor

When using a braking motor, if the braking circuit is directly connected to the inverters's output terminals, the brake cannot be released because of the lowered starting voltage. Therefore, when using a braking motor, connect the braking circuit to the inverter's power supply side, as shown in the figure below. Usually, braking motors produce larger noise in low speed ranges.

Note: In the case of the circuit shown on the left, assign the function of detecting low-speed signals to the RY and RC terminals. Make sure the parameter F130 is set to 4 (factory default setting).

To users of our inverters



To users of our inverters

Selecting the capacity (model) of the inverter

Selection

Capacity

Refer to the applicable motor capacities listed in the standard specifications.
When driving a high-pole motor, special motor, or multiple motors in parallel, select such an inverter that the sum of the motor rated current multiplied by 1.05 to 1.1 is less than the inverter's rated output current value.

Acceleration/deceleration times

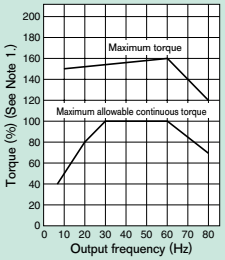
The actual acceleration and deceleration times of a motor driven by an inverter are determined by the torque and moment of inertia2 of the load, and can be calculated by the following equations.
The acceleration and deceleration times of an inverter can be set individually. In any case, however, they should be set longer than their respective values determined by the following equations.

Acceleration time	$ta = \frac{(JM+JL)\times\Delta N}{9.56\times(TM-TL)}$ (sec.)
Deceleration time	$ta = \frac{(JM+JL)\times\Delta N}{9.56\times(TB+TL)}$ (sec.)
Conditions	JM : Moment of inertia of motor (kge.m²) JL : Moment of inertia of load (kge.m²) (converted into value on motor shaft) △N : Difference in rotating speed between before and after acc. or dce. (min.⁻¹) TL : Load torque (Ne.m) TM : Motor rated torque x 1.2-1.3 (Ne.m) ... V/f control : Motor rated torque x 1.5 (Ne.m) ... Vector operation control TB : Motor rated torque x 0.2 (Ne.m) (When a braking resistor or a braking resistor unit is used: Motor rated torque x 0.8-1.0 (Ne.m))

Allowable torque characteristics

When a standard motor is combined with an inverter to perform variable speed operation, the motor temperature rises slightly higher than it normally does during commercial power supply operation. This is because the inverter output voltage has a sinusoidal (approximate) PWM waveform. In addition, the cooling becomes less effective at low speed, so the torque must be reduced according to the frequency.
When constant-torque operation must be performed at low speeds, use a Toshiba VF motor designed specifically for use with inverters.

[An example of V/f control at a base frequency of 60 Hz]



Note 1. 100% of torque refers to the amount of torque that the motor produces when it is running at a 60Hz-synchronized speed. The starting torque is smaller in this case than that required when power is supplied from a commercial power line. So, the characteristics of the machine to be operated need to be taken into consideration.
Note 2. The maximum allowable torque at 50Hz can be calculated approximately by multiplying the maximum allowable torque at a base frequency of 60Hz by 0.8.

Starting characteristics

When a motor is driven by an inverter, its operation is restricted by the inverter's overload current rating, so the starting characteristic is different from those obtained from commercial power supply operation.
Although the starting torque is smaller with an inverter than with the commercial power supply, a high starting torque can be produced at low speeds by adjusting the V/f pattern torque boost amount or by employing vector control. (200% in sensorless control mode, though this rate varies with the motor characteristics.) When a larger starting torque is necessary, select an inverter with a larger capacity and examine the possibility of increasing the motor capacity.

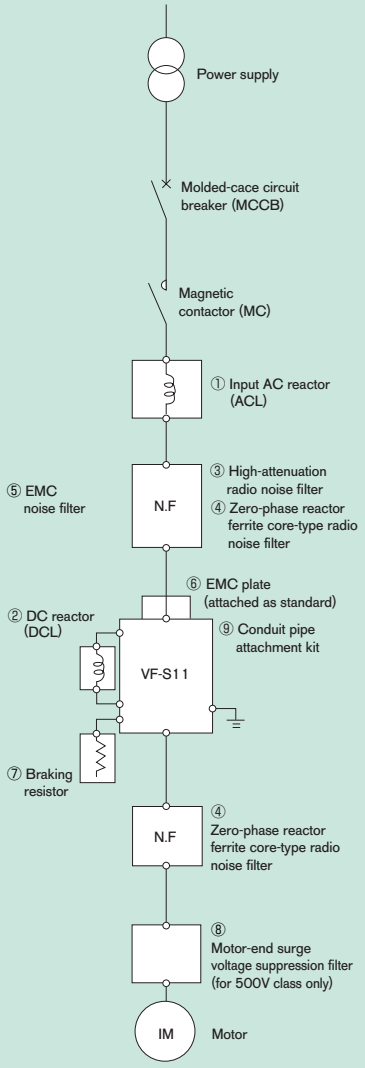
Harmonic current and influence to power supply

Harmonics are defined as sinusoidal waves that is multiple freguency of commercial power (base frequency: 50Hz or 60Hz). Commercial power including harmonics has a distorted waveform.
Some electrical and electronic devices produce distorted waves in their rectifying and smoothing circuits on the input side. Harmonics produced by a device influence other electrical equipment and facilities in some cases (for example, overheating of phase advancing capacitors and reactors).

Measures for suppressing higher harmonics

No	Measures	Description
1	Connecting a reactor	The leakage of a harmonic current from an inverter can be restricted by connecting an input AC reactor (ACL) on the input side of the inverter or a DC reactor (DCL) to the DC section of the inverter.
2	Connecting a higher harmonic suppressing unit (SC7)	A PWM converter that shapes the waveform of an input current into a substantially sinusoidal waveform. The leakage of a harmonic current from a power supply can be restricted by connecting a harmonic suppressing unit (SC7).
3	Connecting a higher harmonic suppressing phase advancing capacitor	A harmonic current can be absorbed by the use of a phase advancing capacitor unit composed of a phase advancing capacitor and a DC reactor.
4	Multi-pulse operation of transformation	For delta-delta connection and delta-Y connection transformers, the effect of 12 pulses can be obtained by distributing the load evenly, and thus currents containing fifth-order and seventh-order harmonics can be suppressed.
5	Other measures	Harmonic currents can also be suppressed by the use of passive (AC) and active filters.

Optional external devices



No.	Device	Function and purpose	Refer to
①	Input AC reactor (ACL)	Used to improve the input power factor, reduce the harmonics, and suppress external surge on the inverter power source side. Install when the power capacity is 200 kVA or more and 10 times or more than the inverter capacity or when a distorted wave generation source such as a thyristor unit or a large-capacity inverter is connected in the same distribution system.	P.17
②	DC reactor (DCL)	Generally, a DC reactor improves the power factor more than a DC reactor. When the inverter is used along with equipment for which a high degree of reliability is required, an input AC reactor capable of suppressing external surges should be used along with a DC reactor.	
③	Radio noise reduction filter — High-attenuation radio noise filter (NF type)	These types of filters are not necessary because all single-phase 240V or 3-phase 500V models have a built-in EMI noise filter, conforming to Class A, as standard. But install these filters if necessarily of noise reduction move and more. • Effective to prevent interference in audio equipment used near the inverter. • Install on the input side of the inverter. • Provided with wide-range attenuation characteristics from AM radio bands to near 10MHz. • Use when equipment readily affected by noise is installed in the peripheral area.	P.18
④	Radio noise reduction filter — Zero-phase reactor ferrite core-type radio noise filter	• Effective to prevent interference in audio equipment used near the inverter. • Effective in noise reduction on both input and output sides of the inverter. • Provided with attenuation characteristics of several dB in frequencies from AM radio bands to 10MHz. • For noise countermeasures, insert on the secondary side of the inverter.	P.18
⑤	Radio noise reduction filter — EMC noise filter (Compliant with European standards)	A high-attenuation compact EMI noise filter that can be Foot-mounted and Side-mounted. With this filter on, the inverter complies with the following standards. Three-phase 240V model: EN55011: Class A, Group 1 (Motor connecting cable length: 5 m or less) And EN55011: Class B, Group 1 (Motor connecting cable length: 1 m or less) Single-phase 240V, three-phase 500V models: EN55011: Class B, Group 1 (Motor connecting cable length: 20 m or less) And EN55011: Class A, Group 1 (Motor connecting cable length: 50 m or less)	Soon to be released
⑥	EMC plate (attached as standard)	A steel plate used to connect shielded earth wires from inverter's power cables or to connect earth wires from external devices.	P.7
⑦	Braking resistor	Use when rapid deceleration or stop is frequently required or when it is desired to reduce the deceleration time with large load. This resistor consumes regenerative energy during power generation braking. • Braking resistor - With (resistor + protective thermal relay) built in.	P.19
⑧	Motor-end surge voltage suppression filter (for 500V class only)	Use an insulation-reinforced motor or install the surge voltage restraint filter to prevent degrading motor insulation caused by surge voltage generation depending on cable length and wiring method, or use of a 400V class motor driven with an inverter.	P.18
⑨	Conduit pipe attachment kit	Attachment kit used for conformance to NEMA TYPE1.	Soon to be released
⑱	DIN rail kit	Available for the 2.2kW (or 1.5kW) or less. (Model: DIN003Z, DIN005Z)	
⑪	Parameter writer	Use this unit for batch read, batch copy, and batch writing of setting parameters. (Model: PWU001Z)	P.19
⑫	Extension panel	Extended operation panel kit provided with LED indication section, RUN/STOP key, UP/DOWN key, Monitor key, and Enter key. (Model: RKP001Z)	
⑬	RS232C communication converter cable	This unit allows you to connect a personal computer to inverters for data communications. (Model: RS20035)	
⑭	Internal RS485 communication circuit board	This unit allows you to connect a personal computer to multiple inverters for data transfer. (Model: RS4003Z)	P.20
⑮	RS485 communication converter unit	This unit allows you to connect a personal computer to multiple inverters for data transfer. (Models: RS4001Z, RS4002Z)	
⑯	Remote panel	This panel includes a frequency meter, a frequency regulator and RUN/STOP (forward/reverse run)switches. (Model: CBVR-7B1)	

Reactor type — Effect

Reactor type	Improvement of power factor	Suppression of harmonic: 200V-3.7kW or less	Suppression of harmonic: Other model	Suppression of external surge
Input AC reactor	○	○	○	○
DC reactor	○ Large	○	○ Large	×

○Large : Large effective. ○: effective. ×: ineffective

Input AC reactor (ACL)

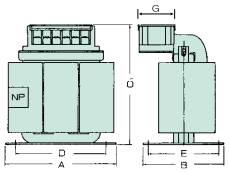


Fig. A

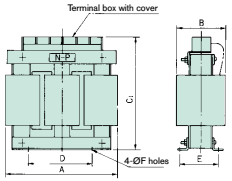
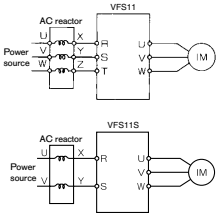


Fig. B



Model	Rating	Inverter type	Dimensions (mm)							Diagram	Terminals	Approx. weight (kg)
			A	B	C	D	E	F	G			
PFLS2002S	1-phase 240V -2.0A-50/60Hz	VFS11S-2002PL (Note)	80	55	115	63	45	5	45	A	Harmonica terminal M3.5	0.85
PFL2001S	3-phase 240V -1.7A-50/60Hz	VFS11-2002PM	105	65	115	90	55	5	40		Harmonica terminal M3.5	1.0
PFL2005S	3-phase 240V -5.5A-50/60Hz	VFS11-2004～2007PM VFS11S-2004PL	105	65	115	90	55	5	40		Harmonica terminal M3.5	1.2
PFL2011S	3-phase 240V -11A-50/60Hz	VFS11-2015、2022PM VFS11S-2007PL	130	70	140	115	60	5	50		Harmonica terminal M4	2.3
PFL2018S	3-phase 240V -18A-50/60Hz	VFS11-2037PM VFS11S-2015、2022PL	130	70	140	115	60	5	50		Harmonica terminal M4	2.5
PFL2025S	3-phase 240V -25A-50/60Hz	VFS11-2055PM	125	100	130	50	83	7	—		Harmonica terminal M4	2.6
PFL2050S	3-phase 240V -50A-50/60Hz	VFS11-2075、2110PM	155	115	140	50	95	7	—	B	Harmonica terminal M6	3.4
PFL2100S	3-phase 240V -100A-50/60Hz	VFS11-2150PM	230	150	210	60	90	8	—		Harmonica terminal M8	8.2
PFL4012S	3-phase 500V -12.5A-50/60Hz	VFS11-4004～4037PL	125	95	130	50	79	7	—	B	Harmonica terminal M4	2.3
PFL4025S	3-phase 500V -25A-50/60Hz	VFS11-4055～4110PL	155	110	155	50	94	7	—			4.9
PFL4050S	3-phase 500V -50A-50/60Hz	VFS11-4150PL	155	140	165	50	112	7	—		Harmonica terminal M6	6.6

Note: PFLS2002S has 4 terminals.

DC reactor (DCL)

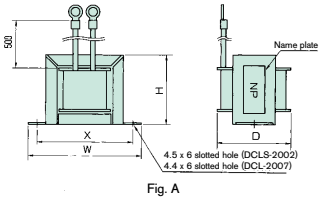


Fig. A

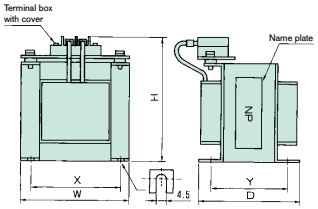


Fig. B

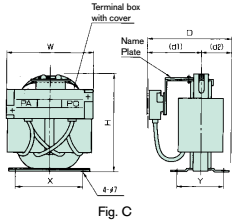
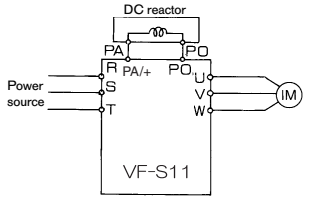


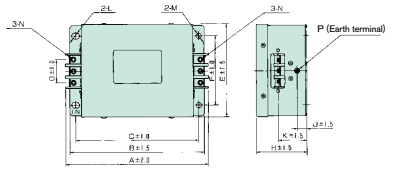
Fig. C

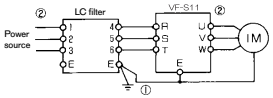


Model	Rated current (A)	Inverter type	Dimensions (mm)							Diagram	Terminals	Approx. weight (kg)
			W	H	D	X	Y	d1	d2			
DCL-2002	2	VFS11-2002PM	59	37	35	51	—	—	—	A	V1.25-3.5	0.2
DCLS-2002	2.5	VFS11S-2002PL	79	50	44	66	—	—	—		V1.25-3.5	0.6
DCL-2007	7	VFS11-2004～2007PM VFS11S-2004PL	92	65	70	82	—	—	—		V2-3.5	1.2
DCL-2022	14	VFS11-2015、2022PM VFS11S-2007PL	86	110	80	71	64	—	—	B	M4	2.2
DCL-2037	22.5	VFS11-2037PM VFS11S-2015、2022PL	86	110	85	71	70	—	—		M4	2.5
DCL-2055	38	VFS11-2055PM	75	130	140	50	85	85	55	C	M5	1.9
DCL-2110	75	VFS11-2075～2110PM	100	150	150	65	85	95	55		M6	2.4
DCL-2220	150	VFS11-2150PM	117	170	190	90	90	130	60		M8	4.3
DCL-2007	7	VFS11-4004～4015PL (Note)	92	65	70	82	—	—	—	A	V2-3.5	1.2
DCL-2022	14	VFS11-4022、4037PL (Note)	86	110	80	71	64	—	—	B	M4	2.2
DCL-4110	38	VFS11-4055～4110PL	95	150	165	70	90	105	60	C	M5	3.0
DCL-4220	75	VFS11-4150PL	105	160	185	80	100	130	65		M8	3.7

Note: VFS11-4004PL-4037PL are used DC reactor for 240V class.

High-attenuation radio noise filter (NF type)



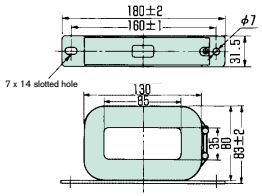


Note:(1) Noise filter should be connected to the inverter main circuit primary-side.
(2) Output cable should be kept away from the input cable.

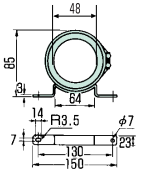
Reactor model	Rated current (A)	Inverter type	Dimensions (mm)												Approx. weight (kg)
			A	B	C	E	F	G	H	J	K	M	N	P	
NF3005A-MJ	5	VFS11-2002PM～VFS11-2007PM	174.5	160	145	110	80	32	70	20	45	Ø5.5	M4	M4	1.0
NF3015A-MJ	15	VFS11-2015PM, VFS11-2022PM													1.6
NF3020A-MJ	20	VFS11-2037PM													
NF3030A-MJ	30	VFS11-2055PM													
NF3040A-MJ	40	VFS11-2075PM	217.5	200	185	120	90	44			43		M5		2.7
NF3050A-MJ	50	VFS11-2110PM	267.5	250	235	170	140		90	30	60	Ø6.5	M6		4.6
NF3080A-MJ	80	VFS11-2150PM	294.5	280	260	170	150	37	100		65			M6	7.0
NF3010C-MJ	10	VFS11-4004～4037PL	174.5	160	145	110	80	32	70	20	45	Ø5.5	M4	M4	1.4
NF3015C-MJ	15	VFS11-4055PL													1.6
NF3020C-MJ	20	VFS11-4075PL													
NF3030C-MJ	30	VFS11-4110PL	177.5	200	185	120	90	44			43		M5		2.7
NF3040C-MJ	40	VFS11-4150PL	217.5												

Note: Every inverter with a model number ending in-PL comes standard with a built-in noise filter almost equal in size and performance to this filter.

Zero-phase reactor ferrite core-type radio noise filter

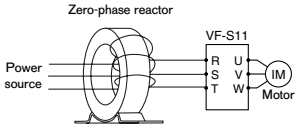


Model: RC9129



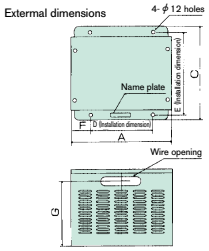
Model: RC5078

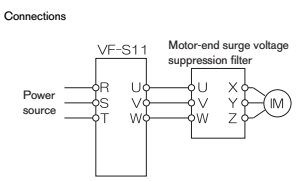
Unit: mm



Input or output cable sould be coiled over 4-times.
RC5078 is recommended for the models 4.0kW or less.

Motor-end surge voltage suppression filter (for 500V class only)





■Measures to protect motors against surge voltages
In a system in which a 500V-class general-purpose motor is operated with a voltage PMW inverter that uses an ultra high-speed switching device (such as an IGBT), surge voltages may be produced and deteriorate the insulation of motor coils, depending on the cable length, wiring method, cable constant, and so on. Here are some examples of measures against surge voltages.
(1) Use motors with a high dielectric strength.
(2) To suppress surge voltages, install an AC reactor (an input reactor may be used instead. For the application, contact your Toshiba dealer) or a surge suppression filter on the output side of the inverter.

Motor-end surge voltage suppression filter I	Applicable motor (kW)	Dimensions (mm)							Terminal screw	Grounding screw	Approx. weight (kg)
		A	B	C	D	E	F	G			
MSF-4015Z	0.4, 0.75, 1.5	310	255	300	200	270	55	189	M4	M4	12
MSF-4037Z	2.2, 4.0	310	255	300	200	270	55	209	M4	M4	20
MSF-4075Z	5.5, 7.5	310	315	350	200	320	55	249	M5	M5	30
MSF-4150Z	11, 15	330	350	400	200	370	65	289	M5	M5	40

Devices	External dimensions and connections

Braking resistor

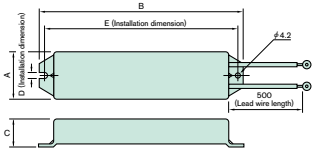


Fig. A

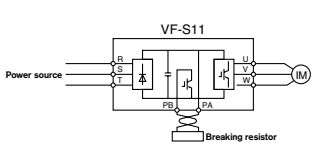


Fig. C

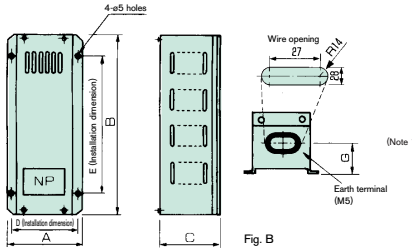


Fig. B

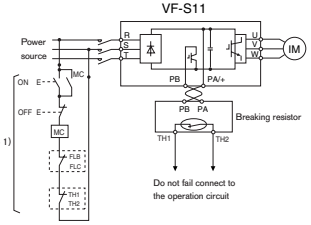


Fig. D

Model	Rating	Inverter type	Dimensions (mm) A	B	C	D	E	G	External dimensions and connections	Approx. weight (kg)
PBR-2007	120W-200Ω	VFS11-2002～2007PM VFS11S-2002～2007PL	42	182	20	4.2	172	—	A and C	0.28
PBR-2022	120W-75Ω	VFS11-2015, 2022PM VFS11S-2015, 2022PL								
PBR-2037	120W-40Ω	VFS11-2037PM								
PBR3-2055	240W-20Ω(40Ω×2P)	VFS11-2055PM	120	320	115	110	230	50	B and D	4
PBR3-2075	440W-15Ω(30Ω×2P)	VFS11-2075PM		350	190			150		4.5
PBR3-2110	660W-10Ω(30Ω×3P)	VFS11-2110PM								5
PBR3-2150	880W-7.5Ω(30Ω×4P)	VFS11-2150PM								5.5
PBR-2007	120W-200Ω	VFS11-4004～4022PL	42	182	20	4.2	172	—	A and C	0.28
PBR-4037	120W-160Ω	VFS11-4037PL								
PBR3-4055	240W-80Ω(160Ω×2P)	VFS11-4055PL	120	320	115	110	230	50	B and D	4
PBR3-4075	440W-60Ω(120Ω×2P)	VFS11-4075PL		350	190			150		4.5
PBR3-4110	660W-40Ω(120Ω×3P)	VFS11-4110PL								5
PBR3-4150	880W-30Ω(120Ω×4P)	VFS11-4150PL								5.5

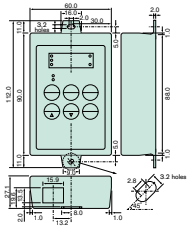
Note1: Use the same type of braking resistor of VFS11-2002 ~ 2007PM for those of VFS11-4004 ~ 4022PL.
Note2: The data in Rating above refer to the resultant resistance capacities (watts) and resultant re-sistance values (Ω).
The numeric values inside parentheses refer to the internal compositions of resistors.

Parameter writer

Extension panel

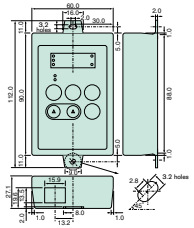
Parameter writer

Parameter writer type: PWU001Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015



Extension panel

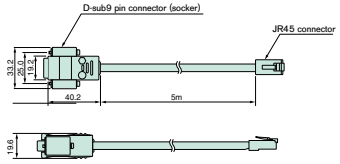
Extension panel type: RKP001Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015



RS232C communication converter cable

RS232C cable type: RS20035

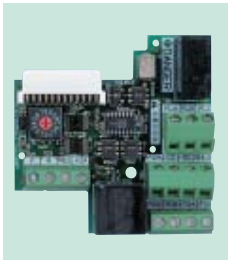
Note: For information about the software program that enables you to set parameters using a personal computer.



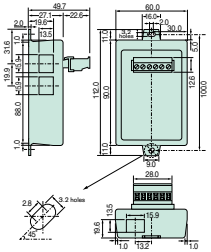
Devices	External dimensions and connections

Internal RS-485 communication board / RS485 communication converter unit

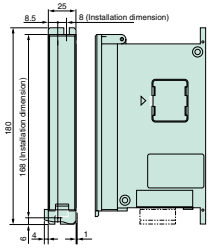
・Board type: RS4003Z



・2-port type: RS4001Z



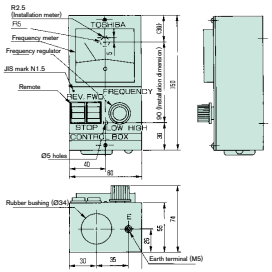
・8-port type: RS4002Z



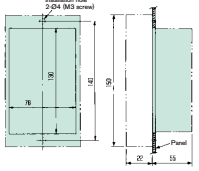
Cable type (1m): CAB0011, (3m): CAB0013, (5m): CAB0015

Remote panel CBVR-7B1

Note: The meter is different from that provided for the former operation panel CBVR-7B but there are no differences in outside dimensions or mounting dimensions.

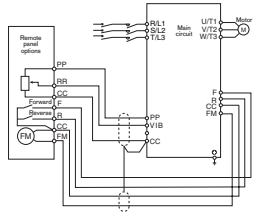


Panel hole



Painting: JIS mark 5Y7/1
(Panel front N1.5)
Weight: 0.7kg

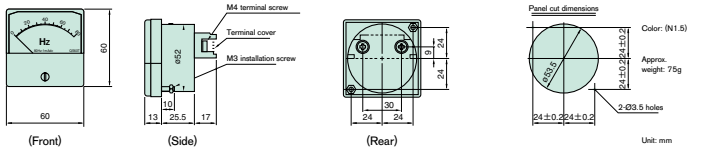
VF-S11



Note: The wire length should be 30m or less the inverter and the remote panel.

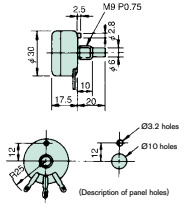
Frequency meter QS60T

Frequency meter <QS-60T (80Hz-1mAdc)>

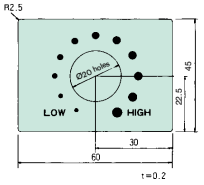


FRH kit

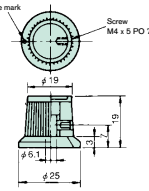
Frequency setting resistor
<RV30YN-20S-B302>



Frequency setting panel



Frequency setting knob <K-3>



Totally enclosed box type

Soon to be released

Possible to bring into compliance with IP55 specifications!

- **Totally enclosed structure compliant with IP54**
- **Built-in noise filter**
- **Equipped with all control devices as standard**
  (Control devices compliant with IP55 specifications / All-in-one)
- **Built-in motor circuit breaker**
- **A minimum of wiring**
- **Cooling structure: Self-cooling type**

■Line-up

Input voltage class	Applicable motor (kW)									
	0.2	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15
1-phase 240V	■	■	■	■						
3-phase 240V		■	■	■	■	■				
3-phase 500V			■	■	■	■	Under developing			

Note) 500V class 5.5 to 15kW range are IP00 type.

■Compliance with IP55

IP54-compliant structures refer to structures that protect the contents from dust and harmful effects of water that drops from every direction. The inverter can be brought into compliance with IP55 specifications by making the wiring port watertight. (IP55-compliant structures refer to structures that protect the contents from dust and harmful effects of water that comes in a jet from every direction.)

■External dimensions

Input voltage class	Aplicable motor (kW)	Type-form	Dimensions (mm)		
			Width	Height	Depth
3ph-240V	0.4	VFS11-2004PME	210	240	177
	0.75	VFS11-2007PME			
	1.5	VFS11-2015PME	215	297	206
	2.2	VFS11-2022PME			
	4.0	VFS11-2037PME	230	340	222
3ph-500V	0.4	VFS11-4004PLE	215	297	206
	0.75	VFS11-4007PLE			
	1.5	VFS11-4015PLE			
	2.2	VFS11-4022PLE	230	340	222
	4.0	VFS11-4037PLE			
1ph-240V	0.2	VFS11S-2002PLE	210	240	177
	0.4	VFS11S-2004PLE			
	0.75	VFS11S-2007PLE			
	1.5	VFS11S-2015PLE	215	297	206
	2.2	VFS11S-2022PLE	230	340	222

■Standard specifications

* Other specifications are the same as those of the standard type. See common specification on page 6.

Item			Specification					
Input voltage class			1ph-240V input class / 3ph-240V input class / 3ph-500V input class					
Applicable motor (kW)			0.2	0.4	0.75	1.5	2.2	4.0
Model	Input voltage class	Type	Form					
	1ph-240V class	VFS11S-	2002PLE	2004PLE	2007PLE	2015PLE	2022PLE	–
	3ph-240V class	VFS11-	–	2004PME	2007PME	2015PLME	2022PME	2037PME
	3ph-500V class	VFS11-	–	4004PLE	4007PLE	4015PLE	4022PLE	4037PLE
Rating	Capacity(kVA) Note 1)		0.6	1.3/1.3/1.1	1.8	3.1	4.2	6.7/7.2
	Rated output current (A) Note 2)	1ph-240V class	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	–
		3ph-240V class	–	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	17.5 (16.4)
		3ph-500V class	–	1.5 (1.5)	2.3 (2.1)	4.1 (3.7)	5.5 (5.0)	9.5 (8.6)
	Output voltage Note 3)		240V class : 3ph-200V to 240V, 500V class : 3ph-380V to 500V					
	Overload current ratingd		60 seconds at 150%, 0.5 seconds at 200%					
Power supply	Voltage-frequency		240V class : 1ph/3ph-200V to 240V -50/60Hz, 500V class : 3ph-380V to 500V -50/60Hz					
	Allowable fluctuation		Voltage +10%, -15% Note4), frequency ±5%					
	Protective method		IP54 Totally enclosed type (JEM1030) / Possible to bring into compliance with IP55					
	Cooling method		Self-cooling					
	Color		Munsel 5Y-8/0.5					
	Built-in filter		1ph and 500V class : High-attenuation EMI filter, 3ph-240V class : Basic filter					
Environments	Service environments Note 6)		Indoor, altitude 1000m or less. Place not exposed to direct sunlight and free from of corrosive and explosive gases.					
	Ambient temperature		-10 to +40°C					
	Storage temperature		-25 to +70°C					
	Relative humidity		20 to 93%					
	Vibration		5.9 m/s² or less (10 to 55Hz)					

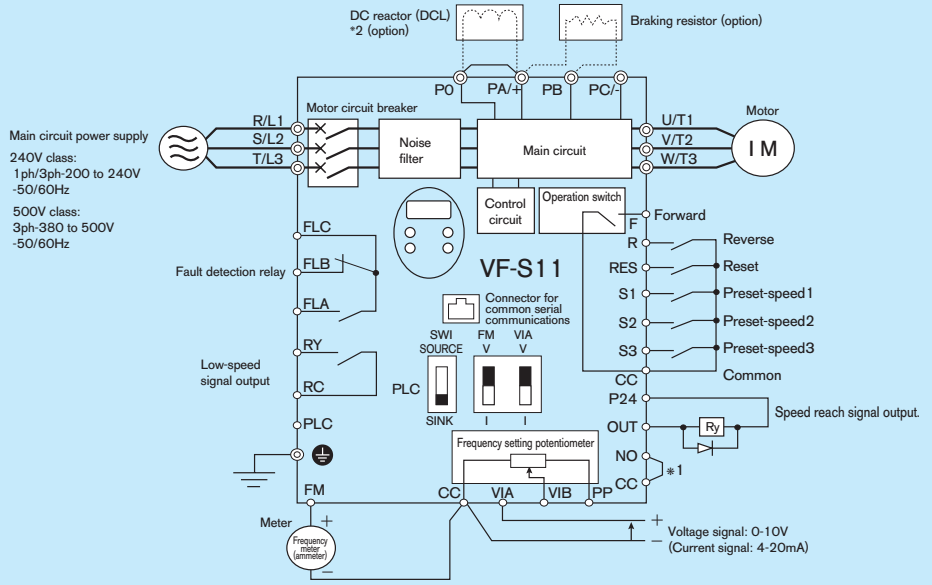
Note 1: Capacity is calculated at 220V for the 240V class and at 440V for the 500V class.
Note 2: Indicates rated output current setting when the PWM carrier frequency (Parameter F300) is 4kHz or less.
When exceeding 4kHz , the rated output current setting is indicated in the parenthesis.
Note 3: The maximum output voltage is equal to the input supply voltage.
Note 4: ±10% when the inverter is operated continuously (under a load of 100%).
Note 5: The factory default settings of the following parameters are different from those of the standard type.
The factory default settings of all other parameters are the same as those of the standard type. For parameter settings, see the tables of parameters on page 10.

Title	Function	VF-S11 Standard type	VF-S11 totally enclosed type
CMOd	Command mode selection	1	0
FMOd	Frequency setting mode selection	0	2

Note 6: Installation environment
· Install the inverter in a well-ventilated place and mount it on a flat metal plate in portrait orientation.
Install the inverter so that it is not inclined more than ±10° from the vertical.
· Leave a space of 10 cm or more on the upper and lower sides of the inverter, and a space of 5 cm or more on each side.
· The inverter has a cooling fan to circulate air in it. The cooling fan has a useful life of approximately 30,000 hours (2 to 3 years when operated continuously), so it needs to be replaced periodically.

■Standard connection diagram

Sink (Negative) logic : Common = CC



*1: When using the OUT output terminal in a sink logic configuration, do not short-circuit the NO and CC terminals.
*2: The inverter comes with the PO and PA (positive) terminals short-circuited with a shorting bar. When connecting a DC reactor (DCL), detach the shorting bar.